US 20110227751A1

(19) **United States**

(12) **Patent Application Publication**

KUO et al.

(10) **Pub. No.: US 2011/0227751 A1**

(43) **Pub. Date: Sep. 22, 2011**

(54) **SUNROOF AND VEHICLE HAVING SAME**

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(21) Appl. No.: **12/857,570**

(22) Filed: **Aug. 17, 2010**

(30) **Foreign Application Priority Data**

Mar. 19, 2010 (TW) 99108207

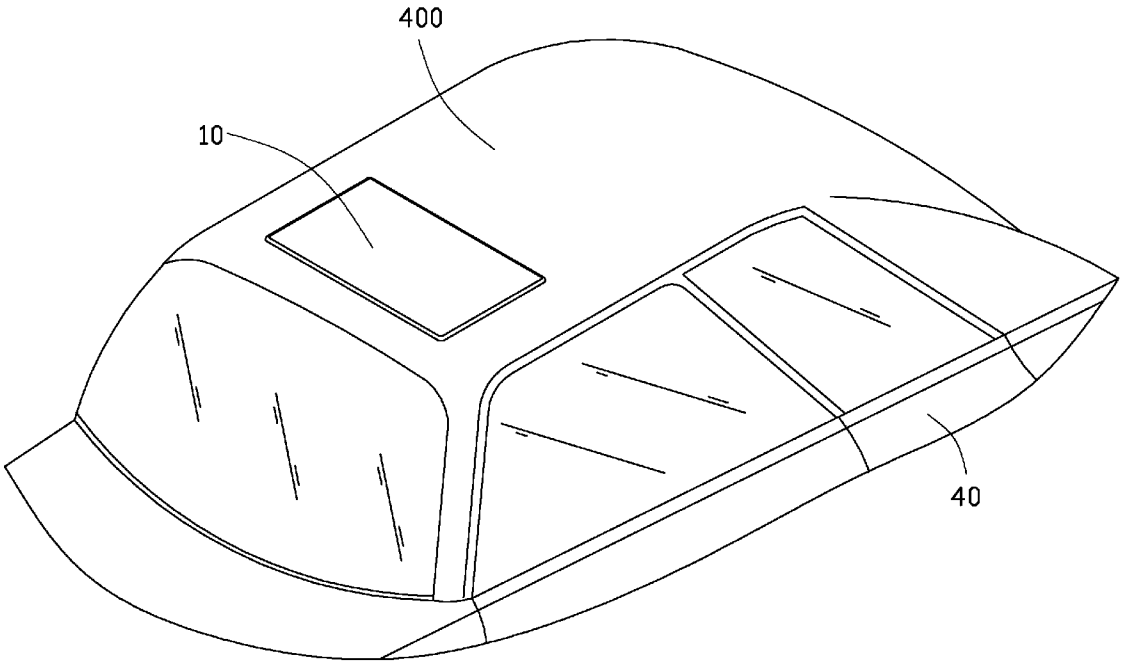
Publication Classification

(51) **Int. Cl.**
G08B 21/00 (2006.01)
B60J 7/08 (2006.01)

(52) **U.S. Cl.** **340/689**; 296/216.02

(57) **ABSTRACT**

An exemplary sunroof for mounting in a vehicle roof is provided. The sunroof includes a panel and a warning apparatus. The sunroof includes a first bottom surface for facing toward an inside of the vehicle. The warning apparatus includes a PCB attached to the panel, and a warning unit mounted on the first bottom surface and electrically connected to the PCB. The warning unit is configured to send an emergency alert signal when the panel is raised up to be substantially perpendicular to the vehicle roof. A vehicle includes the sunroof is also provided.



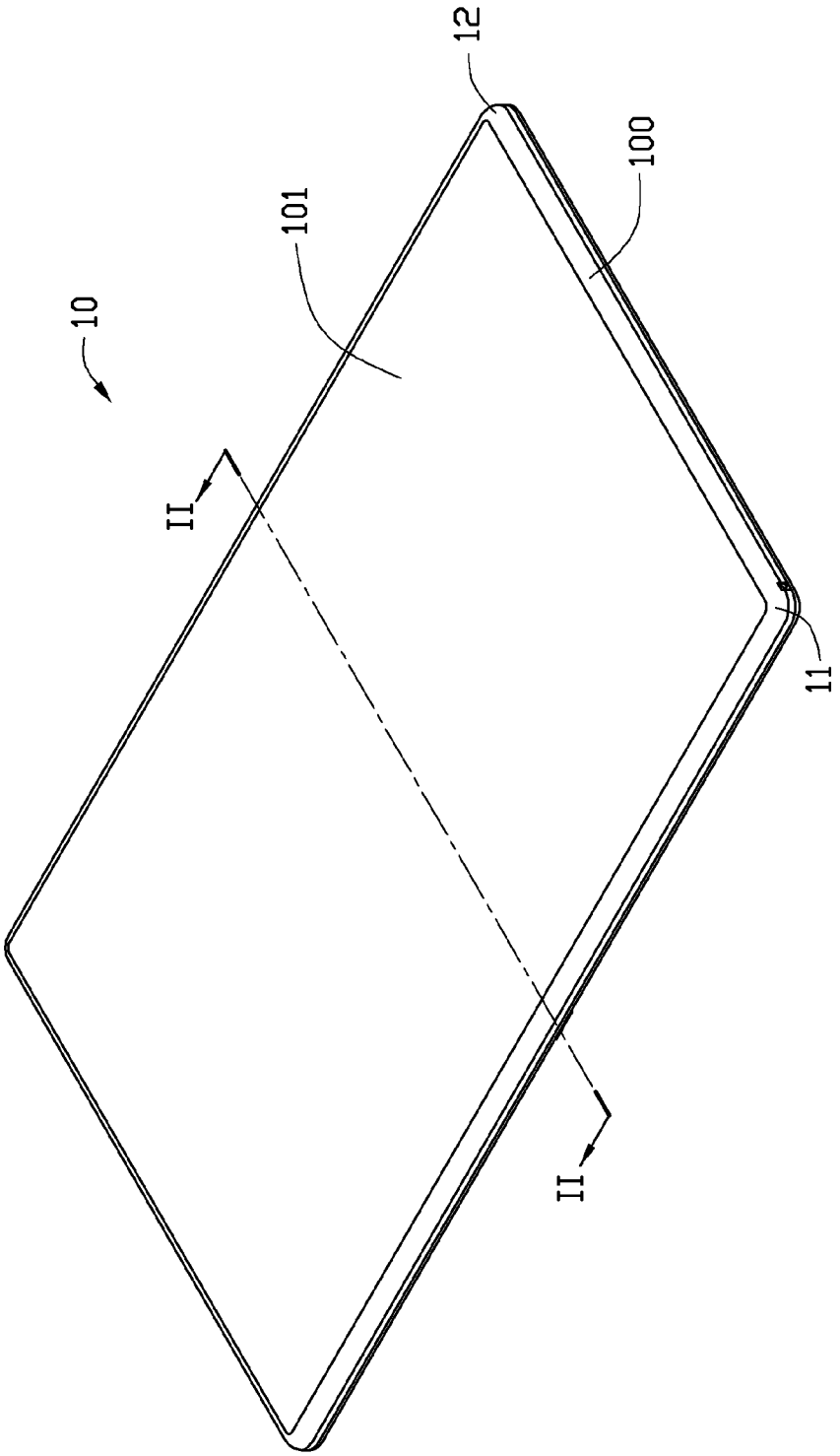


FIG. 1

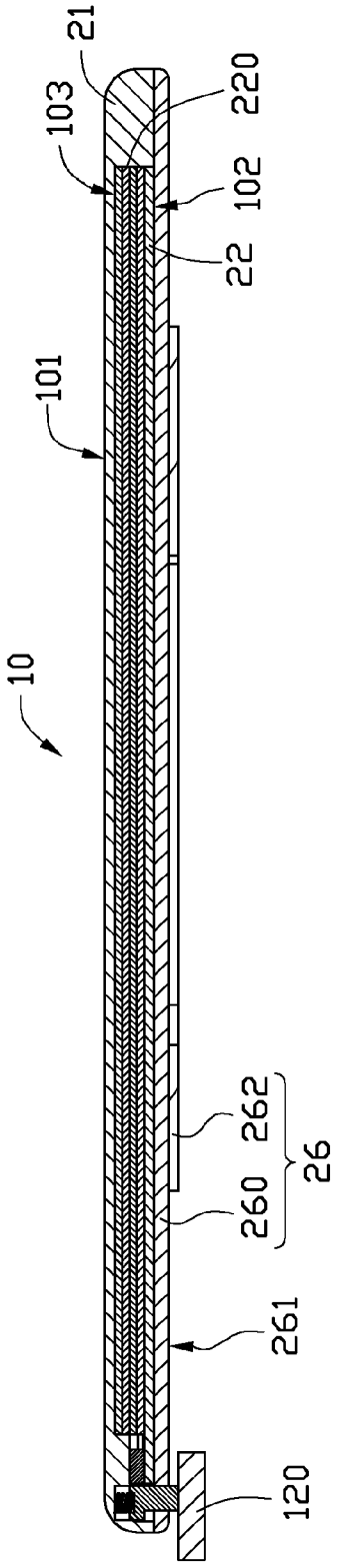


FIG. 2

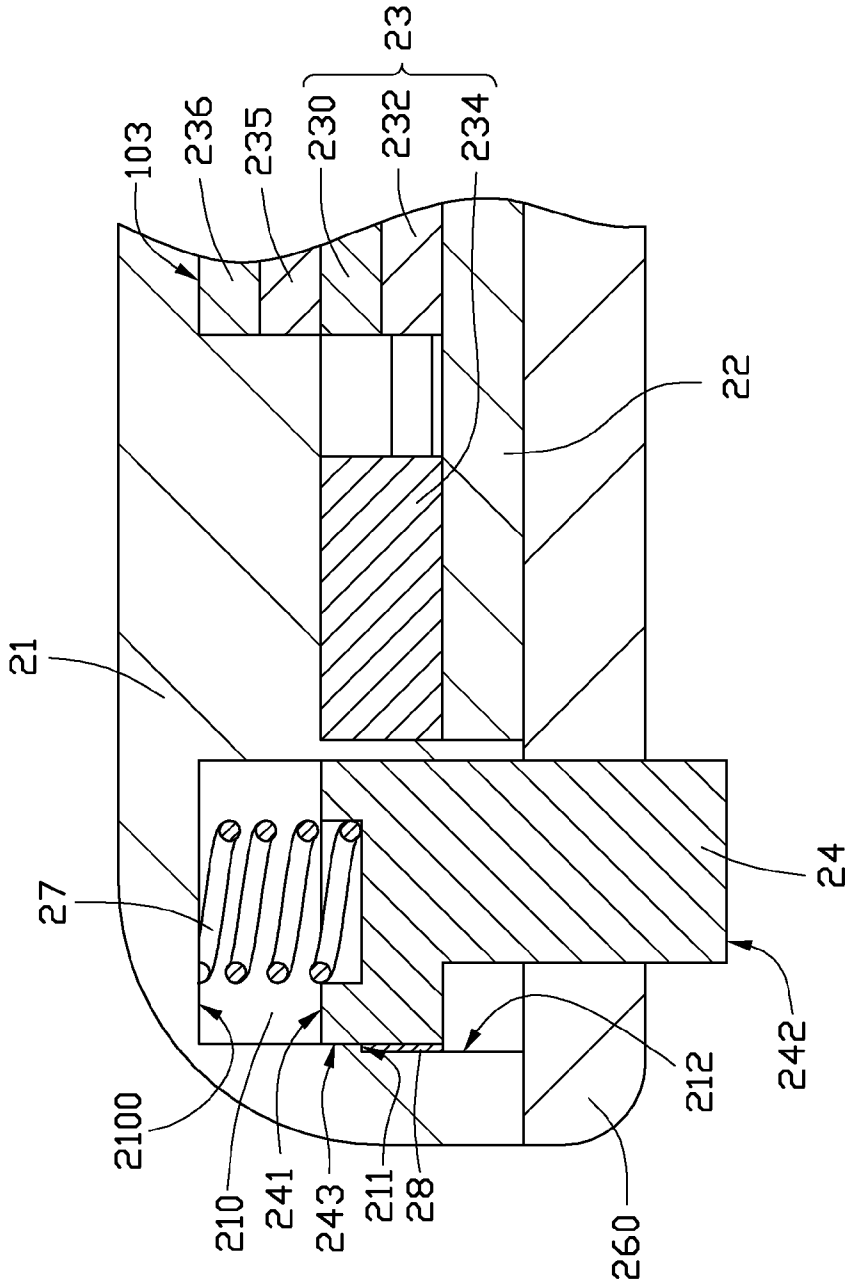

23
103
236
235
230
232
234
22
21
27
24
2100
210
241
243
211
28
260
212
242

FIG. 3

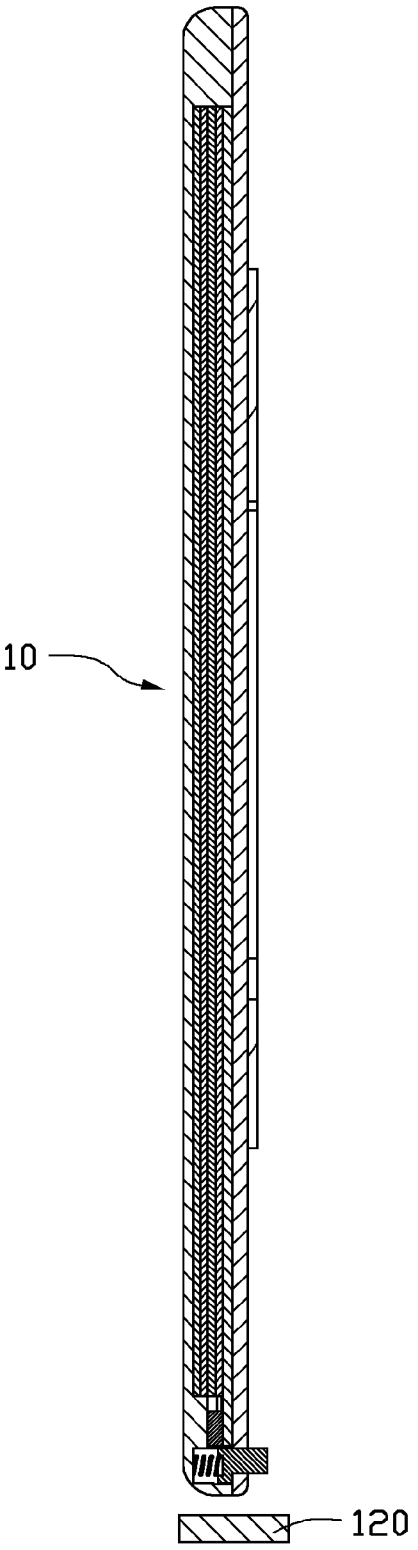


FIG. 4

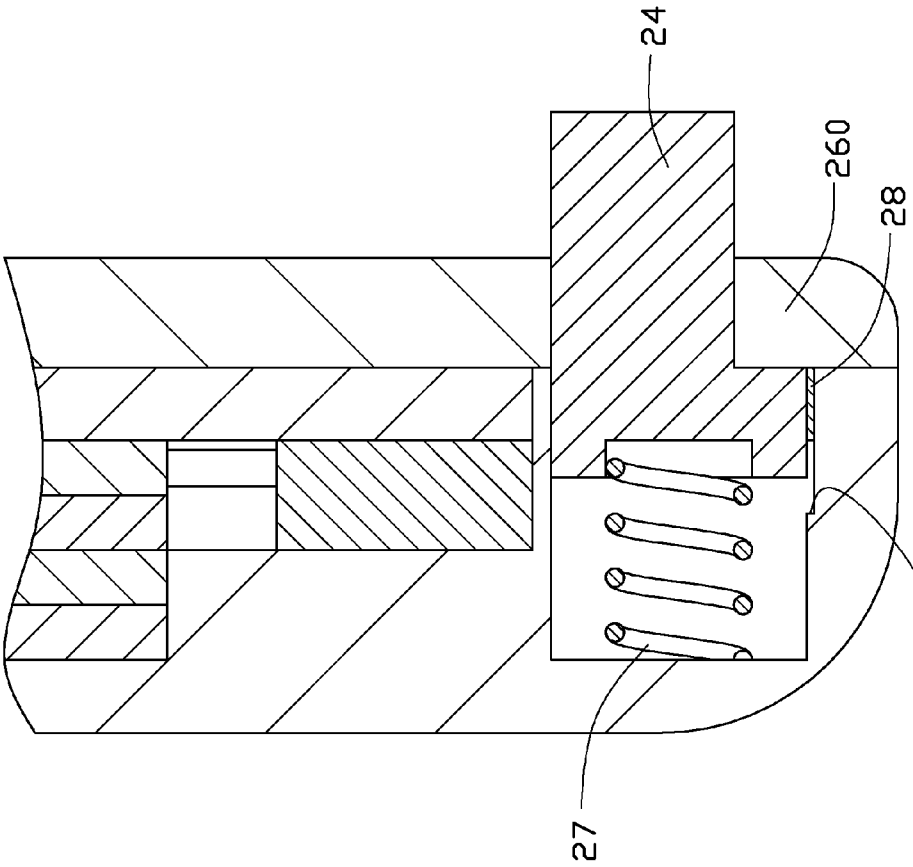


FIG. 5

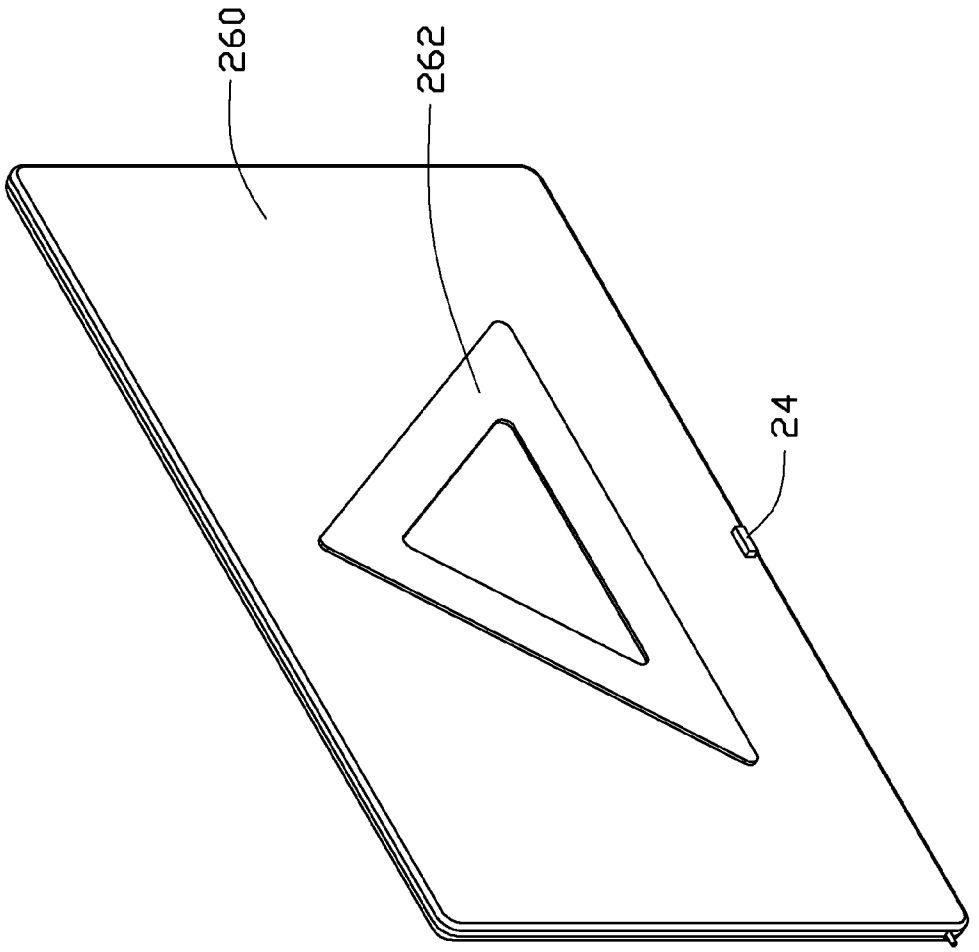


FIG. 6

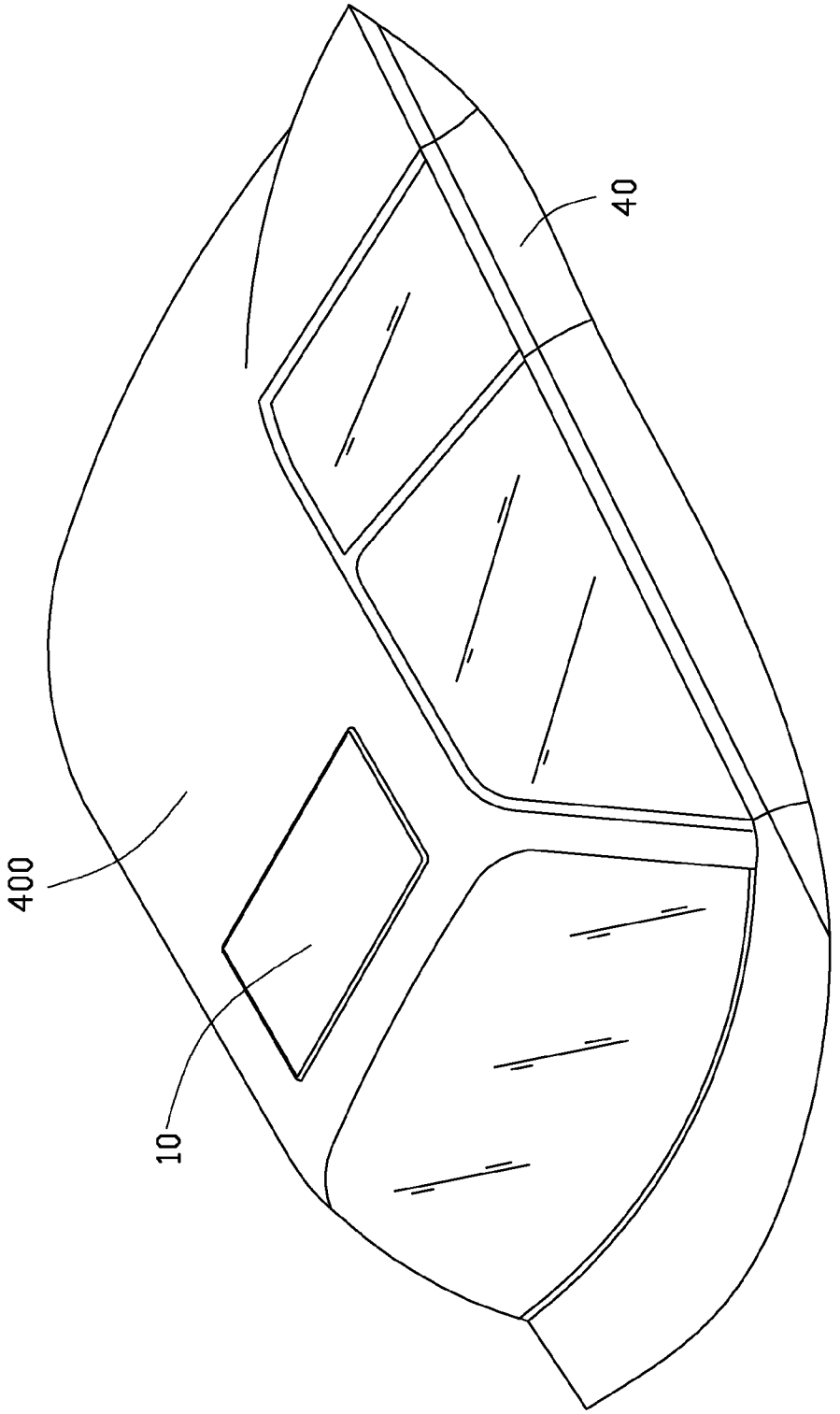


FIG. 7

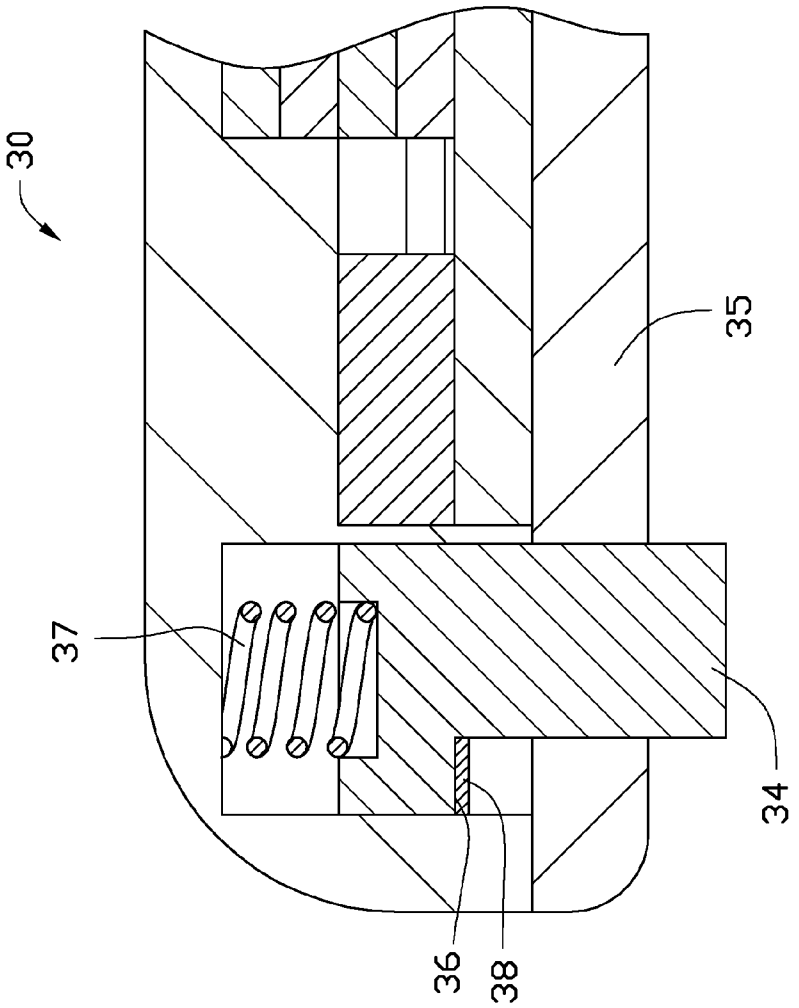


FIG. 8

SUNROOF AND VEHICLE HAVING SAME

BACKGROUND

[0001] 1. Technical Field

[0002] This disclosure relates, in general, to sunroofs, and more particularly, to a multi-purpose solar powered sunroof, and a vehicle including the sunroof.

[0003] 2. Description of Related Art

[0004] When a car breaks down on the road it becomes a hazard, and so it is necessary to alert traffic the hazard with flares and or a reflective sign. However, it takes time for the driver to set up these warnings and the driver is in danger during this time.

[0005] What is needed, therefore, is a warning system that can be immediately deployed from within the vehicle, which can overcome the above shortcomings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Many aspects of the present sunroof and the vehicle can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present sunroof and the vehicle. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the views.

[0007] FIG. **1** is a perspective view of a sunroof in accordance with the first exemplary embodiment.

[0008] FIG. **2** is a cross-sectional view of the sunroof of FIG. **1** generally taken along line II-II.

[0009] FIG. **3** is a partial, enlarged view of the sunroof shown in FIG. **2**.

[0010] FIG. **4** is similar to FIG. **2**, but showing the sunroof in raised to a position substantially perpendicular to a stopper of a vehicle roof.

[0011] FIG. **5** is a partial, enlarged view of the raised up sunroof of FIG. **4**.

[0012] FIG. **6** is a perspective view of the raised up sunroof.

[0013] FIG. **7** is a partial, perspective view of a vehicle having the sunroof of FIG. **1**.

[0014] FIG. **8** is a partial, sectional view of a sunroof in accordance with a second exemplary embodiment.

DETAILED DESCRIPTION

[0015] Referring to FIGS. **1** and **3**, a sunroof **10** includes a panel **100**, a warning apparatus **26**, and a switch **24**. A vehicle **40** (see FIG. **7**) includes a compartment. The compartment has a vehicle roof **400** defining an opening. The sunroof **10** is mounted in the vehicle roof **400** at the opening.

[0016] The panel **100** includes a cover **21** and a base **22**. A front end **11** of the panel **100** is oriented toward the front of the vehicle **40**, and a rear end **12** is oriented toward the rear of the vehicle **40**. The cover **21** has a top surface **101** and an inner surface **103**. The base **22** has a bottom surface **102**. The cover **21** has a first recess **210** defined in the front end **11**, and a separate second recess **220** defined between the inner surface **103** and the base **22**.

[0017] The warning apparatus **26** includes a printed circuit board (PCB) **260** and a warning unit **262**. The warning unit **262** is electrically connected to the PCB **260**. The PCB **260** is attached to the panel **100**. In this embodiment, the PCB **260** is underneath the base **22** and seals or covers the first recess **210**. The PCB **260** has a bottom surface **261** faces the inside of the vehicle **40**. The warning unit **262** is mounted on the bottom surface **102**, particularly, underneath the bottom surface **261**. The warning unit **262** is configured to send an emergency alert signal when the panel is raised up to be substantially perpendicular to the vehicle roof.

[0018] In other embodiments, the PCB **260** is available in many shapes and sizes, and the PCB **260** may instead be located underneath and cover the first recess **210**.

[0019] The warning unit **262** may be any one or more of a liquid crystal display, a light emitting diode module, and a reflective sign board. Here, the warning unit **262** is a triangular light emitting diode module including a number of light emitting diodes. The warning sign can be easily seen by at least anyone approaching the vehicle **40** from behind when the panel **100** is raised up to an angle of, for instance, 90 degrees (see FIG. **4**).

[0020] Referring to FIGS. **3**, **4** and **5**, the switch **24** electrically connected to a power source is configured to switch on or switch off the warning unit **262**. The switch **24** has a first end surface **241**, an opposing second end surface **242** substantially parallel to the first end surface **241**, and a third end surface **243** substantially perpendicularly connected to the first end surface **241**. A conductive member **28** is positioned between the first end surface **241** and the second end surface **242**, and attached to the third end surface **243**.

[0021] The first recess **210** has an opening and a bottom surface **2100**. The switch **24** is inserted into the first recess **210** extending through the PCB **260** and the opening, leaving the second end surface **242** contacting with a stopper **120** underneath the first recess **210** configured for triggering the switch **24**. The first end surface **241** faces the bottom surface **2100**.

[0022] The switch **24** is spring loaded for automatic activation by placing a resilient member **27** applying a force to the switch **24** in a direction from the first end surface **241** to the second end surface **242**. The first end surface **241** is initially in contact with the stopper **120** when the panel **100** seals the opening of the vehicle roof **400**, and the conductive member **28** is disconnected from the PCB **260** (see FIGS. **2** and **3**), and the warning unit **262** is switched off. When the panel **100** is raised up to be substantially perpendicular to the vehicle roof **400**, the first end surface **241** leaves the stopper **120**, the resilient member **27** rebounds activating the switch **24** so that the conductive member **28** is connected with the PCB **260**, and thus, the warning unit **262** is switched on (see FIGS. **4**, **5**, and **6**). A variety of types of lifter mechanisms proposed could be used here to lift the sunroof **10** up to a desired angle relative to the vehicle roof **400**.

[0023] It is noteworthy that the stopper **120** is a part of the sunroof **10**, or a part of the vehicle roof **400**. Besides the third end surface **243**, the conductive member **28** may be attached to the other position of the switch **24** as long as the conductive member **28** is capable of contacting with the PCB **260**.

[0024] Furthermore, the panel **100** includes an inner side wall **212** in the first recess **210**. The inner side wall **212** is substantially perpendicular to the bottom surface **2100**. A step surface **211** defined in the inner side wall **212** is configured to block the movement of the conductive member **28** as well as the switch **24** toward the second bottom surface **2100**.

[0025] The vehicle **40** includes a power source **23**. Referring to the FIG. **3**, the power source **23** is located in the second recess **220**. The power source **23** includes a sheet shaped solar cell panel **230**, a sheet shaped battery **232**, and a controller **234**. The sheet shape of the solar cell panel **230** and the battery **232** allows convenient placement of the components inside

the panel **100**. The power source **23**, in another embodiment, is located outside the second recess **220** but in the sunroof **10**, or inside the vehicle roof **400**. Here, the cover **21** is transparent. The solar cell panel **230** faces away form the inside of the compartment. The warning unit **262** is electrically coupled to the solar cell panel **230**.

[0026] The solar cell panel **230** includes monocrystalline silicon solar cells, polycrystalline silicon solar cells, or a variety of types of thin film solar cells. The solar cell panel **230** converts the solar energy into electricity. The battery **232** stores the electricity. The controller **234**, electrically connected with the battery **232**, controls the type of the current, direct current or alternating current, provided to the electronic devices of the vehicle **40**, for example, the warning unit **262**, the interior ventilation fan, or the headlight.

[0027] If desired, added protection for the solar cell panel **230** may be provided by the addition of a transparent plastic layer **235** and a transparent protecting film **236** on the solar cell panel **230**.

[0028] Referring to FIG. **8**, the sunroof **30** of a second embodiment is almost the same as the sunroof **10**. A difference is, the switch **34** has a middle surface **36** substantially parallel and located between the two end surfaces of the switch **34**, and a conductive member **38** is attached to the middle surface **36**. When the switch **34** is activated by the resilient member **37**, the conductive member **38** will contact a PCB **35**, and the warning unit is turned on.

[0029] Sunroofs adopting the present warning apparatus provide a safe and efficient method for deployment of hazard warning devices. Furthermore, the sunroofs are environmentally friendly by using solar energy to provide the vehicle with electricity.

[0030] It is understood that the above-described embodiments are intended to illustrate rather than limit the disclosure. Variations may be made to the embodiments without departing from the spirit of the disclosure. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the disclosure.

What is claimed is:

1. A sunroof for mounting in a vehicle roof of a vehicle, comprising:
- a panel comprising a first bottom surface for facing toward an inside of the vehicle; and
- a warning apparatus comprising:
  - a PCB attached to the panel, and
  - a warning unit mounted on the first bottom surface and electrically connected to the PCB, the warning unit configured to send an emergency alert signal when the panel is raised up to be substantially perpendicular to the vehicle roof.

2. The sunroof according to claim **1**, further comprising:
- a switch electrically connected with the warning apparatus, the switch comprising a conductive member, and the panel further comprising:
  - a front end oriented toward the front of the vehicle, a first recess defined in the front end, the PCB covering the first recess, the first recess including a second bottom surface facing toward the inside of the vehicle, the switch inserted into the first recess and extending through the PCB and being movable relative to the second bottom surface between a first position where the conductive member is connected with the PCB and the warning unit is switched on, and a second position where the conductive member is disconnected from the PCB and the warning unit is switched off.

3. The sunroof according to claim **2**, wherein the switch further comprises:
- a body having a first end surface facing the second bottom surface and an opposing second end surface substantially parallel to the first end surface; and
- a resilient member between the second bottom surface and the second end surface configured to applying a force to the body in a direction from the first end surface to the second end surface.

4. The sunroof according to claim **3**, wherein the switch further comprises a third end surface substantially perpendicularly connected between the first and second end surfaces, and the conductive member attached to the third end surface.

5. The sunroof according to claim **3**, wherein the switch further comprises a middle surface substantially parallel to and located between the first and second end surfaces, and the conductive member attached to the middle surface.

6. The sunroof according to claim **3**, further comprising a stopper for triggering the switch.

7. The sunroof according to claim **2**, wherein the panel comprises an inner side wall in the first recess, the inner side wall substantially perpendicular to the second bottom surface, and having a step surface configured to block movement of the conductive member toward the second bottom surface.

8. The sunroof according to claim **1**, wherein the panel further comprises:
- a second recess defined in the panel; and
- a power source located in the second recess.

9. The sunroof according to claim **8**, wherein the power source comprises:
- a solar cell panel configured for converting the solar energy into electricity.

10. The sunroof according to claim **9**, wherein the solar cell panel includes a battery configured for storing the electricity.

11. The sunroof according to claim **1**, wherein the warning unit is a liquid crystal display, a light emitting diode module, or a reflective sign board.

12. A vehicle comprising:
- a compartment having a vehicle roof defining an opening;
- a sunroof mounted in the vehicle roof at the opening, the sunroof comprising:
  - a panel comprising a bottom surface facing toward an inside of the compartment; and
  - a warning apparatus comprising:
    - a warning unit configured to send an emergency alert, and
    - a switch configured for sensing an orientation of the panel and switching on or switching off the warning unit;
    - the panel being movable relative to the vehicle roof between a first position where the panel seals the opening and the warning unit is switched off, and a second position where the panel is substantially perpendicular to the vehicle roof, and the warning unit is switched on.

13. The vehicle according to claim **12**, further comprising:
- a solar cell panel facing away from the inside of the compartment, the warning unit electrically coupled to the solar cell panel.

14. The vehicle according to claim **13**, wherein the switch is spring-loaded.

15. The vehicle according to claim **14**, further comprising a stopper mounted on the vehicle roof for deactivating the switch, when the panel is in the first position.

16. The vehicle according to claim **13**, wherein the warning unit is a display panel electrically coupled to the solar panel.

17. A sunroof for mounting in a roof of a vehicle, comprising:

a panel comprising a front end for facing the front end of the vehicle, a rear end for facing the rear end of the vehicle, a bottom surface facing an inner of the vehicle, wherein the front end is hinged to the roof, and the read end is orientable to a desired angle relative to the roof; and

a warning apparatus comprising a warning unit mounted on the bottom surface, the warning unit configured to send an emergency alert signal when the panel is raised up to be substantially perpendicular to the vehicle roof.

18. The sunroof according to claim **17**, wherein the warning unit includes a reflective sign board.

19. The sunroof according to claim **17**, wherein the warning unit is an electrical apparatus, and the warning apparatus further comprises:

a switch located at the front end configured for sensing an orientation of the panel and switching on when the rear end is lifted to be perpendicular to the roof.

20. The sunroof according to claim **17**, wherein the switch is spring-loaded.

* * * * *